FACTOR ANALYSIS OF BEACH SEDIMENT AT DAMLATAS BEACH (ALANYA, TÜRKIYE)

Prof Dr Mustafa Gurhan YALCIN (Orcid ID: 0000-0002-8011-5371)
Akdeniz University, Department of Geological Engineering, Antalya, 07058, Türkiye
gurhanyalcin@akdeniz.edu.tr

Dr. Student Sezer UNAL
Akdeniz University, Department of Geological Engineering, 07058 Antalya, Türkiye

Research Assis. Ozge Ozer ATAKOGLU (Orcid ID: 0000-0003-2678-1194)
Akdeniz University, Department of Geological Engineering, 07058 Antalya, Türkiye

Ass. Prof. Dr. Fusun YALCIN (Orcid ID: 0000-0002-2669-1044)
Akdeniz University, Department of Mathematics, 07058 Antalya, Türkiye

ABSTRACT
Alanya Beach is located in the south-west of Alanya. The beach has clear and fine sand. There are many hotels in the area. The sandy beach is quite wide. Factor analysis is a statistical method used to describe the difference between variables related to the study subject. The aim of the study is to make factor analysis by multivariate statistical techniques and interpret the chemical analysis data made from the samples belonging to the study area. In this context, beach sediment samples were collected from the west of Damlatas Castle (Alanya, Antalya). Chemical analysis with X-ray fluorescence (XRF) was performed on beach sands and factor analysis was performed on these data. According to the factor analysis results, most of the element was associated with a natural source. Heavy metals such as Al, K, Ti, Cr, Zn, Rb, Tb have been associated with a mixture of natural rocks and surface/sea water found in the region. However, S, Cl, Br and Ba may have come from anthropogenic sources (e.g. industries, shipping vessels, emissions from trucks, domestic and industrial waste disposal and agricultural land use). It is recommended not to allow anthropogenic wastes in the study area and its immediate surroundings, and to carry out the necessary controls and inspections.

Keywords: multivariate statistical analiysis, factor analysis, Damlatas beach, Alanya.

INTRODUCTION

Human being is exposed to radiation from natural sources, including cosmic and terrestrial sources, in addition to artificial radioactivity from fallout from nuclear testing and medical applications [1]. Radionuclides nuclear weapons tests, and nuclear accidents enter the environment during medical and industrial radiation applications. These artificial sources also make a significant contribution to the total radiation exposure of the population. The effect of radiation in the soil on human health, while the whole body is affected by external radiation directly originating from the primitive radionuclides in the soil, the internal body is affected by radiation due to inhalation [2]. Internal exposure to radiation affecting the respiratory tract, soil, sediment, and radon emitted from building materials is due to its decomposition products [3]. Regional enrichments of natural radioactivity in beach sands are observed all over the world. Beach sands are mineral deposits, usually composed of volcanic rocks such as granite, rhyolite and andesite, and these rocks may be rich in minerals containing U and Th. These minerals, as a result of erosion of rocks, migrate with the help of weather conditions and accumulate and enrich on the coasts [4]. The radiation doses created by the beach sands, which contain minerals with high uranium and thorium concentrations such as monazite and zircon, are considerable high. The main source of beach sand comes from metamorphic and igneous rocks. Some metamorphic and igneous rocks contain natural radionuclides that emit radiation to the environment. 99% of the earth's crust consists of elements namely, oxygen, silicon, aluminum, iron, calcium, sodium, potassium and magnesium. These elements constitute low-density minerals, which are the dominant compounds of silicates and aluminosilicates, which make up 80% of the earth's crust. It is likely to be found in high proportions (e.g. chromium, cobalt, nickel, copper and iron; titanium, vanadium, iron and manganese in mafic rocks; tungsten, molybdenum, tin, uranium, thorium and titanium in granite rocks; lead, zinc, copper, cadmium and mercury in acidic volcanic rocks; cadmium, lead, vanadium and uranium in round) in ultramafic rocks [5]. Radionuclide level information in beach sand is of great importance as it provides important information for keeping reference data records to identify possible changes in environmental radioactivity [6]. Dose rates are common in the world environment and are found in formations that vary from place to place in different geological formations such as soil, sand, water and air in varying concentrations depending on geographical and geological conditions [7-10]. Beach sands, which contain coarse materials rich in inorganic silicon, are weather-resistant remnants of geological formations that are transported to their original places, to the shore, after transport mechanisms such as wind, river, and glacier; and accumulates at the seaside with the movements of waves and currents [11-13]. The development of the nuclear

industry, the rapid spread of techniques that increase radioactive pollution, the determination of radiation in our natural environment; This has made it necessary for the creation of standards to protect people and nature from this pollution [14-16]. The coastal areas of the environment receive natural or anthropogenic radioactive pollution through rivers and precipitation [17]. Marine sediments are the main reservoirs for natural and artificial radionuclides due to their diverse composition. The uptake of radionuclides by marine sediments depends on their physical and chemical properties [18]. The concentration and distribution of 226Ra,232Th and 40K in sands is not uniform throughout the world and their distribution in soil depends on the nature of its geological formation [19-20]. The monazite mineral found in beach sands is considered an important geological material because it can contain 0.1–0.3% uranium and 5–7% thorium, which are the main elements used in nuclear power plants [21]. Radioactivity analysis on tourist beaches plays an interesting role. While distinctive studies have been conducted in various countries and regions of the world on the natural radioactivity of the coastline and the doses it creates, scant studies have been conducted in Turkey. Turkey has the largest beach sand system in Europe [22]. In nearly 10% of our total coastline of 8333 km, 845 km, is covered with beach sands.

Samples could be taken from coastal sediments, stream beds, regularly or irregularly according to the purpose. Chemical analysis of the samples was made by X-ray fluorescence (XRF) methods. Geochemical analyzes are based on elements such as lithium, beryllium, sodium, magnesium, potassium, calcium, titanium, vanadium, chromium, iron, manganese, cobalt, nickel, copper, zinc, arsenic, aluminum, silicon, iodine, sulfur, chlorine, selenium, ribidium, strontium, yibidium, zircon, molybdenum, cadmium, tin, antimony, barium, tungsten, gold, mercury, lead, thorium, uranium. Regional observations of soil/rock geochemistry are utilised to determine the extent and magnitude of artificial contamination sources. Element concentrations in soils are caused by parent material (base rock), atmospheric deposition, fertilization, agrochemicals, organic wastes and other inorganic pollutants (mine deposits and tailings). In this study, 50 beach sand samples were collected from the Alanya beach line. To the west of the Alanya Kalesi, 25 samples labelled with initials A (1 – 25) were collected, and to the east of Alanya Kalesi trending southeast, 25 point were samples and labelled with the initial K (26 – 50). The radioactive element of interest include ^{40}K, ^{232}Th and ^{238}U. ^{231}Pa in addition were identified, but was ignored in this study because advanced XRF is not appropriate technique use for the analysis of such elements.

CONCLUSIONS

Their concentrations above detection limit in the Alanya samples (A-group) ranges as follows: ^{40}K 0.24 – 0.73%, ^{238}U 0.00 – 0.0003 ppm and ^{232}Th were not detected. In the Alanya Kalasi samples (K-group), these elements ranges were ^{40}K 0.24 – 2.26%, ^{238}U 0.00 – 0.0024ppm and ^{232}Th 0.00 – 0.0026 ppm. Their average concentration were ^{40}K 0.49%, U 0.000012 ppm in the Alanya samples, and ^{40}K 1.52%, ^{238}U 0.000248 ppm and ^{232}Th 0.000952 ppm. The average mean concentration of ^{40}K, ^{232}Th and ^{238}U were lower in the Alanya group samples compared to those collected after the Alanya Kalesi (Figure 1 a and b) Heavy metal elements such as Al, Fe, Mg Ti, Co, Zn, Ga, R, Y, Ba, Pb, Pa and Tb were slightly lower in the Alanya (A) samples compared to the Kalesi (K) samples. However, Si, Na, Cl, Dy and Tm were higher in the Alanya samples compared to the Kalesi samples.

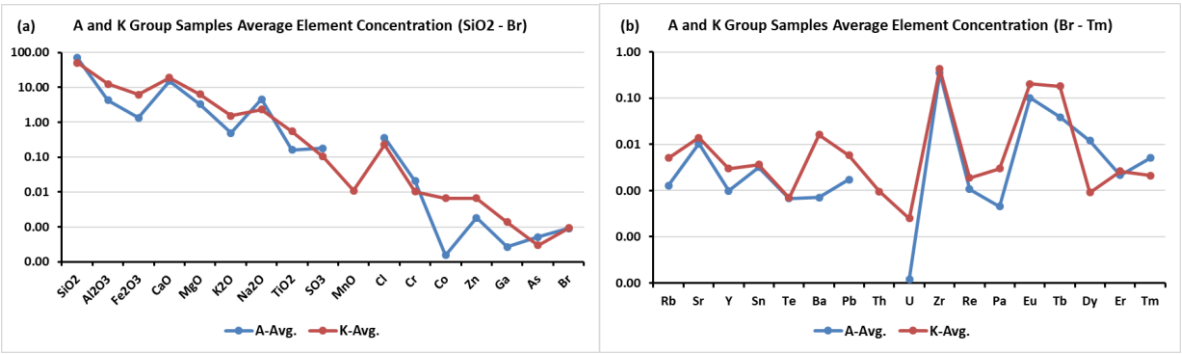


Figure 1. (a) Average Geochemical content of Alanya and Alanya Kalesi Samples; (b) Average Geochemical content of Alanya and Alanya Kalesi Samples

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